A new, unexpected species of the genus *Antheraea* Hübner, 1819 ("1816") from Luzon Island, Philippines (Lepidoptera, Saturniidae)

Stefan Naumann and Johannes H. Lourens

Dr. Stefan Naumann, Hochkirchstrasse 11, D-10829 Berlin, Germany; sn@saturniidae.com
Dr. Johannes H. Lourens, Ridgewood Park, Brgy. Gulang-Gulang, Lucena City 4301, Philippines; janhlourens@yahoo.com

Abstract: A new species of the genus *Antheraea* Hübner, 1819 ("1816") in the subgenus *Antheraea* from the Philippines is described: *A. (A). **hagedorni* sp. n.**, male holotype from Luzon Island, will be deposited in the Zoological Museum of the Humboldt University, Berlin, Germany. The species can be identified by its elongated forewing apex, the typical more or less light orange ground colour, details of fore- and hindwing ocellus, and ornamentation of the males, and details in the very small male genitalia structures. A short comparison to related taxa from the Philippines is given. The new species, a member of the so-called *helferi*-group, *yamamai*-subgroup, within the subgenus, has its nearest relatives on Taiwan and in the PR China, namely *A. (A.) yamamai* (Guérin-Méneville, 1861) and its subordinate or related taxa.

Eine neue, unerwartete Art der Gattung *Antheraea* Hübner, 1819 („1816") von der Insel Luzon, Philippinen (Lepidoptera, Saturniidae)

Zusammenfassung: Eine neue Art der Gattung *Antheraea* Hübner, 1819 („1816") aus dem Subgenus *Antheraea* wird von den Philippinen beschrieben: *A. (A). **hagedorni* sp. n.**, männlicher Holotypus von der Insel Luzon, wird in das Museum für Naturkunde der Humboldt-Universität zu Berlin gelangen. Männchen dieser Art sind charakterisiert durch die länglichen Vorderflügelapices, die typische hell oder dunkler orange Grundfarbe, Details der Vorder- und Hinterflügelozellen und der Zeichnung, sowie Details der sehr kleinen männlichen Genitalstrukturen. Die verwandten Taxa aus der *helferi*-Gruppe sowie die syntop vorkommenden näheren Verwandeten von den Philippinen werden besprochen. Die neue Art, ein Mitglied der sogenannten *helferi*-Gruppe, *yamamai*-Untergruppe, der Untergattung *Antheraea (Antheraea)*, hat überraschenderweise mit *A. (A.) yamamai* (Guérin-Méneville, 1861) und ihren verschiedenen Unterarten und Verwandten die nächsten Verwandten in Taiwan und der Volksrepublik China.

Introduction

The genus *Antheraea* Hübner, 1819 ("1816") was reclassified by Nässig (1991). He separated three different subgenera, namely *Antheraea (Telea* Hübner, 1819 ("1816")), *Antheraea (Antheraeopsis* Wood-Mason, 1886), and *Antheraea (Antheraea* Hübner, 1819 ("1816")), the last one subdivided in several species-groups. It was later further diversified, erecting several more groups and subgroups (review see Paukstadt et al. 2000). An overview about all known taxa of the *helferi*-group, separated into the so-called *helferi*- and *yamamai*-subgroups, was published by Paukstadt & Paukstadt (2007: 222 *ff.*).

In the present paper a new, surprising species of the *yamamai*-subgroup of the *helferi*-group is described from Luzon Island, Philippines. While on all other Philippine islands, except Palawan and smaller islands around, only *A. (A.) halconensis* Paukstadt & Brosch, 1996 is known as sole representative of the *helferi*-group (compare also Lampe et al. 1997, Nässig & Treadaway 1998, Naumann & Nässig 1998), this is a first record of a second member of the *helferi*-group syntopically on the same Philippine Island. Similar situations are known for the islands of Borneo and Sumatra as well as the Malayan Peninsula where, aside of the local *A. (A.) helferi borneensis* Moore, 1892, also *A. (A.) diehli* Lemaire, 1979 is known as a member of the *yamamai*-subgroup (on Sumatra furthermore *A. pratti* Bouvier, 1928 of the *helferi*-subgroup: Nässig et al. 1996). Most likely similar to these two Sundanian islands, the colonization on Luzon by the second member of the group took place obviously during the glaciation periods when sea level was partly 160–180 m lower and land bridges between the present-day Malayan Peninsula, Borneo and Sumatra respectively Luzon, Taiwan and the intermediate Babuyan and Batan Islands existed (de Jong & Treadaway 1993, Hall & Blundell 1996, Treadaway 1998). Vane-Wright (1990) gave an overview about land bridges within the Philippines during Pleistocene and discussed the different faunal parts of that country plus their biogeographic relationships to nearby other islands.

Abbreviations used:

CBH	collection Brosch, Hille, Germany.
CJLP	collection Johannes H. Lourens, Lucena City, Luzon, Philippines.
CSLL	collection Swen Löffler, Lichtenstein, Germany.
CSNB	collection Stefan Naumann, Berlin, Germany.
GP	Genitalia preparation (with number and collection abbreviation).
HT	Holotype.
MNHU	Museum für Naturkunde der Humboldt-Universität zu Berlin, Germany.
PT	Paratype(s).
SMFL	Senckenberg-Museum, Lepidoptera collection, Frankfurt am Main, Germany.

*Antheraea (Antheraea) **hagedorni* n. sp.

Holotype ♂ (Figs. 1, 2): Philippines, Luzon Island (East), Sierra Madre Mountains, Isabela Province [borderline to Aurora Prov.], 17 km NW of Dibulo, 16°32′ N, 122°14′ E, 550 m, primary forest, 21.–22. ix. 2006, leg. J. H. Lourens, received xi. 2006 from Jan Lourens, GP 1557/06 Naumann, barcode SNB 0046 (CSNB). A red holotype label will be fixed accordingly. The holotype will be deposited in the collections of MNHU, Berlin.

© Entomologischer Verein Apollo e. V., Frankfurt am Main

Colour plate, Figs. 1–6: Specimens of *Antheraea (Antheraea)*. **Fig. 1:** *A. (A.) hagedorni* n. sp., HT, dorsal view. **Fig. 2:** HT, ventral view. **Fig. 3:** *A. (A.) hagedorni,* PT, reddish brown morph, dorsal view. **Fig. 4:** *A. (A.) halconensis,* dorsal view, specimen collected syntopically with *A. hagedorni* in Luzon. **Fig. 5:** *A. (A.) superba,* Taiwan, dorsal view. — All specimens in CSNB. Figs. 1–5 to the same scale, scalebar 1 cm. — **Fig. 6:** Biotope of *A. hagedorni* in Luzon, Sierra Madre, Mingan Mts.

© Entomologischer Verein Apollo e. V., Frankfurt am Main

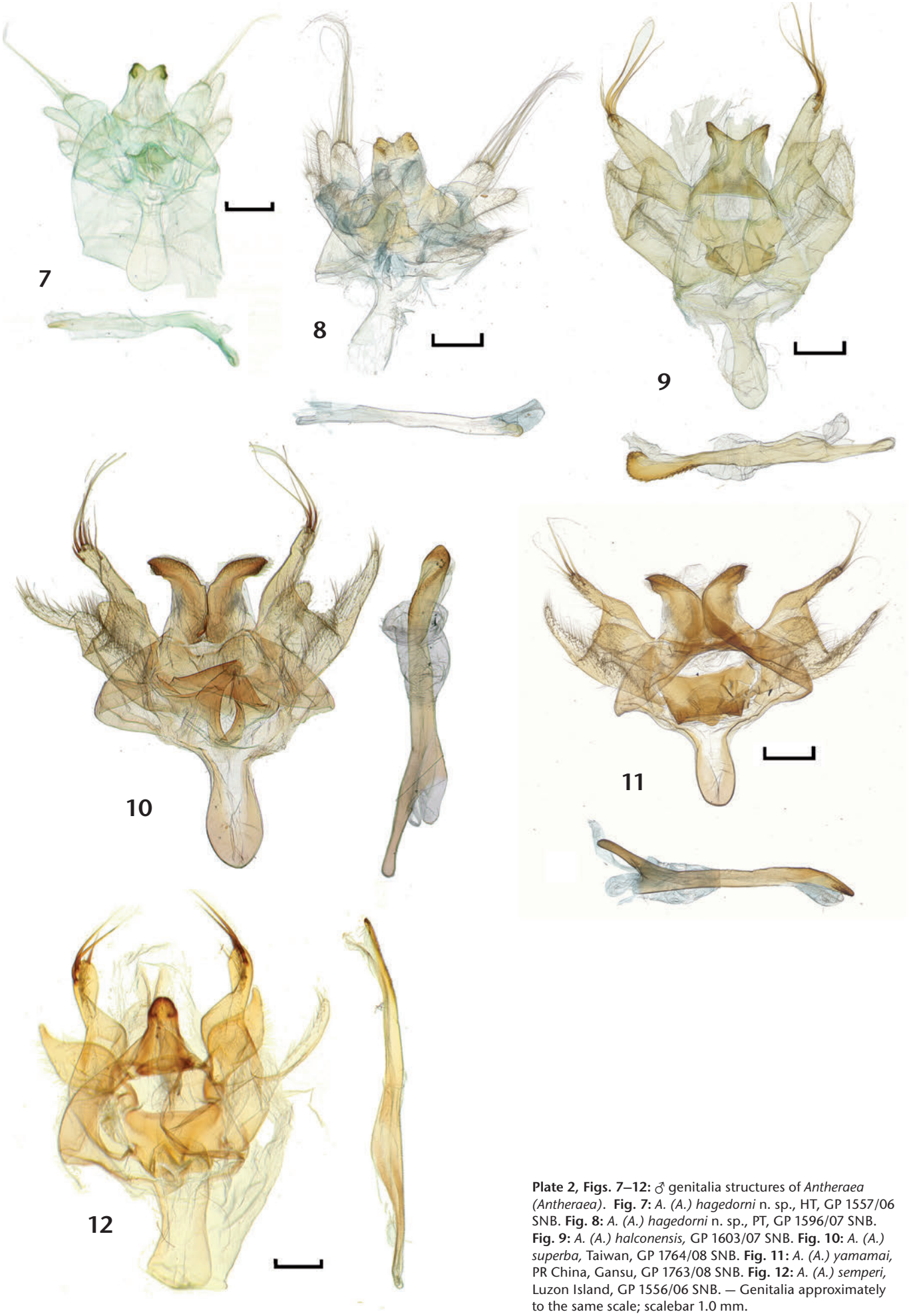

Plate 2, Figs. 7–12: ♂ genitalia structures of *Antheraea (Antheraea)*. **Fig. 7:** *A. (A.) hagedorni* n. sp., HT, GP 1557/06 SNB. **Fig. 8:** *A. (A.) hagedorni* n. sp., PT, GP 1596/07 SNB. **Fig. 9:** *A. (A.) halconensis,* GP 1603/07 SNB. **Fig. 10:** *A. (A.) superba,* Taiwan, GP 1764/08 SNB. **Fig. 11:** *A. (A.) yamamai,* PR China, Gansu, GP 1763/08 SNB. **Fig. 12:** *A. (A.) semperi,* Luzon Island, GP 1556/06 SNB. — Genitalia approximately to the same scale; scalebar 1.0 mm.

© Entomologischer Verein Apollo e. V., Frankfurt am Main

Paratypes (Fig. 3) (in total 39 ♂♂): (all Philippines, Luzon Isl.) 11 ♂♂, same data as holotype, GP 1596/07 Naumann, barcode SNB 0047 (CSNB); 16 ♂♂, same data as holotype (CJLP); 2 ♂♂, (East), Sierra Madre Mountains, Isabela Province [borderline to Aurora Province], 20 km NW Dibulo, 16°31′ N, 122°13′ E, 650 m, primary forest, 23. ix. 2006, leg. J. H. Lourens (CJLP); 6 ♂♂, same data (CSNB); 1 ♂, Ifugao Province, 13 km NE Bontoc, 17°2′ N, 121°3′ E, E Chatol, 1950 m, central highlands, 28. i. 2006, leg. J. H. Lourens (CJLP); 1 ♂, (NW), Cordilleros Region, borderline Abra/Kalinga Provinces, 8 km E Malibcong, 17°29.526′ N, 122°59.802′ E, 1700 m, 8. ii. 2007, leg. J. H. Lourens (CJLP); 1 ♂, Aurora Province, Sierra Madre, Mingan Mts., 28 km W Baler, 16°41.463′ N, 121°23.86′ E, 470 m, 18. vi. 2007, leg. J. H. Lourens (CJLP); 1 ♂, Aurora Province, Sierra Madre, 585 m, 15 km W Dibulo, 16°32.866′ N, 122°14.134′ E, 5.–6. ix. 2007, leg. J. H. Lourens, received iv. 2008 (CSNB). – Blue paratype labels will be fixed accordingly. Some of the specimens of the senior author's collection will be deposited in CSLL, CBH and SMFL.

Derivatio nominis: The new species is dedicated to Mayor Edward S. Hagedorn from Puerto Princesa City in recognition for his efforts for nature conservation on the island of Palawan and his kind support of research on that topic.

Description

♂ (Figs. 1–3): Antennae ochreous brown, 14.5–17.1 mm long, longest rami 3.7–4.3 mm, quadripectinate, apical ca. 2 mm with very short or reduced rami and only bipectinate. Length of right forewing from basis to forewing apex 67.0–73.0 mm (average 69.8 mm, n = 18; HT 67.0 mm). Ground colour on dorsal side variable, most specimens are of dull orange colour, but some are somewhat darker orange or even reddish brown, all with darker brown and greyish pink ornamentation. Proximal two thirds of the forewing costa greyish, apical part in wing colour. Median field in ground colour, antemedian line violet with proximal grey shadow, proximal of the forewing ocellus a typical, dark violet brown pattern along the vein; the forewing ocellus almost round, proximal part violet-pink, distal part of yellow and olive colour, 6.0–7.0 mm in diameter (average 6.6 mm, n = 18), hyaline centre 2.0–3.1 mm (average 2.5 mm, n = 18) in maximum diameter. In some specimens follows a shadow of a dentate median line, the postmedian line almost straight, of violet colour and marginal pinkish white shadows interrupted by the veins; it ends in a greyish violet round forewing apex with curved apical tip. The marginal area again in ground colour, outer margin yellow.

Hindwing of same colour and with same ornamentation: a violet antemedian line, a more intensive dentate median line distal to the round or little oval ocellus of 5.0–6.0 mm maximum diameter, followed by a band of greyish violet triangles, interrupted by the veins, forming the postmedian line. The "eyelid"-like black patch above the hindwing eyespot, typical for most other members of the *helferi*-group, is lacking or very weakly developed. Outer margin again yellow. On ventral side all specimens of similar reddish-brown ground colour with less ornamentation: Ante- and postmedian line almost missing, in some specimens those structures are visible as outlined dark greyish shadow. In the forewing the postmedian area is suffused with violet scales, in the hindwing the median area as well. Forewing apex dark, amost black, outer margin again yellow. Both fore- and hindwing ocelli bordered dark, followed by violet, olive and yellow scales approaching the hyaline center.

♂ genitalia (Figs. 7, 8): Generally in many *Antheraea* species, ♂ genitalia show only few differences, as already mentioned in many works on this genus; main differences within the formal groups erected by Nässig (1991) are the size, form, length and number of bristles on the dorsal valves, length of the phallus, form of uncus and generally the size of the structure. The representatives of the different groups show typical structures. Within the *frithi*-group of subgenus *Antheraea* only scarcely very typical elements such as an ear-like process of the valves can be found, as mentioned by Lane et al. (2004) for *A. lorosae* M. D. Lane, Naumann & D. A. Lane, 2004 from East Timor. In the *helferi*-group two different main subgroups (Holloway et al. 1995: 298, Paukstadt et al. 1998: 321, 2000: 17 *ff.*) can be very well separated, namely the *helferi*- and the *yamamai*-subgroup, by size and form of their valves and the form of the uncus. *A. hagedorni* has to be grouped within the *yamamai*-subgroup.

The genitalia structures of *A. hagedorni* generally are quite small for the genus, especially in comparison to the relatively large moth; the uncus has two double cupolas. The dorsal apex of the valves is short and bears 4 to 5 very long and soft bristles, the central process long and tall, and the ventral process longish, short and covered with short bristles. The sacculus is hairy, the juxta has two central tips. Saccus medium-sized and tall, phallus of 4.5 mm length, with almost no thorns on its distal end, vesica emerging to dorsal side. The structure of the 8th tergite typical for *Antheraea* is almost square-like.

Genitalia of the new species were compared (see Tab. 1) with those of *A. (A.) yamamai* from PR China (Fig. 11), *A. (A.) superba* Inoue, 1965 from Taiwan (Fig. 10), *A. (A.) halconensis* Paukstadt & Brosch, 1996 (Fig. 9), and *A. (A.) semperi* C. & R. Felder, 1861 (a member of the *frithi*-group, Fig. 12), the latter two from the type locality of *A. (A.) hagedorni* in Luzon, plus (not figured and not mentioned in the table) *A. (A.) helferi* Moore, 1859 and *A. (A.) diehli* Lemaire, 1979.

♀ and preimaginal instars: unknown.

Discussion

The main series of *A. (A.) hagedorni* specimens was collected in a very inaccessable area in northeastern Luzon rainforests in altitudes of 470–650 m (Fig. 6: photo of biotope in Aurora province, Sierra Madre, 470 m). Only 2 specimens were found in more central areas of Ifugao and around the borderline of Abra and Kalinga Provinces, those two in altitudes of 1950 and 1700 m, respectively (compare Nelles Maps 2003). This may be the reason why that species was found only

© Entomologischer Verein Apollo e. V., Frankfurt am Main

Table 1: ♂ genitalia characteristics of *Antheraea* species.

	A. hagedorni GP 1557/06, 1596/07 (all S. Naumann)	***A. yamamai*** GP 1763/08	***A. superba*** GP 1764/08	***A. halconensis*** GP 1603/07	***A. semperi*** GP 1556/06
Size	Small	Small	Medium	Medium to large	Medium
Uncus	Two double cupolas	Two incurved, wideley spread processes	Same structure as in *A. yamamai,* but a little larger	Two shorter lateral processes	Single, cone-like, round
Valves	Dorsal apex short with 4–5 long soft bristles, central internal process long and tall, ventral process short with short bristles	Dorsal apex long with 3–4 long bristles, central process round, ventral process long, spoon-like	Same structure as in *A. yamamai,* but a little larger	Dorsal apex long, with 3–4 strong bristles, central process less developed than in *helferi,* longish, ventral process broad, paddle-like	Dorsal apex longish, with 3 strong, straight bristles, central process round, ventral process longish.
Juxta	Central, acute	With hinted central tip	With hinted central tip	Round	Round
Saccus	Tall, round	Broad-based, round	Broad-based, round	Tall, round	Broad-based, longest of all five
Phallus	Length 4.5 mm	Length 5.0 mm	Length 7.0 mm	Length 5.5 mm	Length 8.0 mm

now and not earlier during intensive collecting expeditions by, e.g., A. Schintlmeister or J. Settele (compare Nässig & Treadaway 1998). As mentioned above, the nearest relatives of *A. (A.) hagedorni* do not occur on other Philippine islands nearby but further northward on the island of Taiwan (Fu & Tzuoo 2004) and then on mainland of China, Vietnam, Korea, Russia, and Japan. Another Saturniidae species, namely *Attacus lorquinii* C. & R. Felder, 1861, which is widespread on most northern Philippine islands (except the Mindanao area and Palawan), was recorded from the small island of Calayan which is located north of Luzon between this island and Taiwan (Brechlin & Nässig 2001); *Attacus atlas* (Linnaeus, 1758), which is known from Taiwan, was recorded further north in the Philippines from the Batanes and Babuyanes island groups, just south of Taiwan (Nässig & Treadaway 1998). *A. atlas* as a representative of the Taiwanese fauna was not recorded on the main island of Luzon.

It was tried twice to rear *A. (A.) hagedorni* from eggs deposited by ♀♀ collected in the wild from the type locality in Sierra Madre in 2007 and 2008, to compare the larvae with those of Taiwanese *A. (A.) superba* figured by Wang (1994) and Heppner et al. (1990); in both cases the rearing was attempted on evergreen *Quercus turneri "pseudoturneri"* in Germany, but larvae and resulting specimens in both cases proved to be *A. (A.) halconensis;* those were already figured by Lampe et al. (1997). So far the ♀ of the new species remains unknown, although it may be hidden in series of *A. (A.) halconensis,* just as it is supposed to be a similar situation with the ♀ of *A. (A.) diehli* which is also suspected to look similar to that of the syntopically occurring *A. (A.) helferi borneensis* (Nässig & Beck 2005, Beck & Nässig 2008)

Acknowledgements

We would like to thank the following persons for their support during preparations of that article in various ways: Ulrich Brosch, Hille; Edward S. Hagedorn, Puerto Princesa City; Swen Löffler, Lichtenstein; Wolfgang A. Nässig, Frankfurt am Main; and Alexander Schintlmeister, Dresden.

References

Beck, J., & Nässig, W. A. (2008): Diversity and abundance patterns, and revised checklist, of saturniid moths from Borneo (Lepidoptera: Saturniidae). – Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, N.F. **28** (3/4): 155–164.

Brechlin, R., & Nässig, W. A. (2001): Ein neuer Inselnachweis von *Attacus lorquinii* C. & R. Felder, 1861 aus dem Norden der Philippinen (Lepidoptera: Saturniidae). – Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, N.F. **22** (3): 183–186.

de Jong, R., & Treadaway, C. G. (1993): The Hesperiidae (Lepidoptera) of the Philippines. – Zoologische Verhandelingen, Leiden, **288:** 1–125.

Fu C. M. & Tzuoo H. R. (2004): Moths of Anmashan, part 2. – Taichung (Taichung Nature Research Society), [4] + 263 pp.

Guérin-Méneville, F. E. (1861): *In:* "Séance du 24 avril 1861". – Révue et Magasin de Zoologie pure et appliquée, (2) **13:** 191–192 [+ 402–410, 435–452, pls. 11–13].

Hall, R., & Blundell, D. J. (eds.) (1996): Tectonic evolution of Southeast Asia. – Geological Society Special Publication **106.** – London (Geological Society), xiii + 566 pp.

Heppner, J. B., Wang H. Y. & Chang Y.-C. (1990): Larval morphology of Taiwan Saturniidae (Lepidoptera): *Antheraea yamamai superba* Inoue. – Journal of the Taiwan Museum, Taipei, **43** (1): 95–102.

© Entomologischer Verein Apollo e. V., Frankfurt am Main

Holloway, J. D., Nässig, W. A., & Naumann, S. (1995): The *Antheraea* Hübner (Lepidoptera: Saturniidae) of Sulawesi, with descriptions of new species. Part 1: *Antheraea (Antheraea) rosemariae* n. sp. – Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, N.F. **16** (2/3): 297–308.

Inoue, H. (1965): Four new subspecies of the Attacidae from Japan and Formosa (Lepidoptera). – Tyō to Ga, **15** (3) (for 1964): 56–60.

International Commision on Zoological Nomenclature [ICZN] (1999): International Code of Zoological Nomenclature. – London (International Trust for Zoological Nomenclature), xxix + 306 pp.

Lampe, R. E. J., Nässig, W. A., & Treadaway, C. G. (1997): Anmerkungen zu *Antheraea halconensis* Paukstadt & Brosch 1996 von den Philippinen (Lepidoptera: Saturniidae). – Entomologische Zeitschrift, Essen, **107** (3): 89–109.

Lane, M. D., Naumann, S., & Lane, D. A. (2004): A new species of *Antheraea* Hübner (Lepidoptera: Saturniidae) from East Timor. – Australian Entomologist, **31** (3): 123–130.

Nässig, W. A. (1991): New morphological aspects of *Antheraea* Hübner and attempts towards a reclassification of the genus (Lepidoptera, Saturniidae). – Wild Silkmoths, **'89/'90:** 1–8.

——, & Beck, J. (2005): A greyish brown male form of *Antheraea diehli* Lemaire, 1979 from Borneo (Lepidoptera: Saturniidae). – Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, N.F. **26** (4): 181–182.

——, Lampe, R. E. J., & Kager, S. (1996): The Saturniidae of Sumatra (Lepidoptera). (*Including:* Appendix I: The preimaginal instars of some Sumatran and South East Asian species of Saturniidae, including general notes on the genus *Antheraea* (Lepidoptera)). – Heterocera Sumatrana, Göttingen, **10:** 3–170.

——, & Treadaway, C. G. (1998): The Saturniidae (Lepidoptera) of the Philippines. – Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, **Supplementum 17:** 223–424.

Naumann, S., & Nässig, W. A. (1998): Two new species of *Antheraea (Antheraea)* of the *helferi*-group from Eastern Indonesia (Lepidoptera: Saturniidae). – Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, N.F. **18** (4): 319–330.

Nelles Maps (2003): Philippines, 1 : 1 500 000. – München (Nelles).

Paukstadt, U., & Brosch, U. (1996): Zwei neue Arten der Gattung *Antheraea* Hübner [1819] von der Insel Mindoro, Philippinen (Lepidoptera: Saturniidae). – Entomologische Zeitschrift, Essen, **106** (12): 513–519.

——, ——, & Paukstadt, L. H. (2000): Preliminary checklist of the names of the worldwide genus *Antheraea* Hübner, 1819 ("1816") (Lepidoptera: Saturniidae). Part I. – Galathea, Berichte des Kreises Nürnberger Entomologen, Nürnberg, **Supplementum 9:** 1–59.

——, Paukstadt, L. H. (2007): A preliminary annotated checklist of the Indonesian wild silkmoths – Part IV B. The *yamamai*-subgroup of the *helferi*-group of the genus *Antheraea* Hübner, 1819 ("1816") (Lepidoptera: Saturnidae: Saturniinae). – Beiträge zur Kenntnis der wilden Seidenspinner, Wilhelmshaven, **5** (5): 217–248.

——, ——, & Brosch, U. (1998): Taxonomische Änderungen und Anmerkungen zu den Taxa der Gattung *Antheraea* Hübner [1819] von Sumatera, Indonesien (Lepidoptera: Saturniidae). – Entomologische Zeitschrift, Essen, **108** (8): 317–324.

Treadaway, C. G. (1998): Short introduction to Philippine natural and geological history and its relevance for Lepidoptera. – Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, **Supplementum 17:** 7–16.

Vane-Wright, R. I. (1990): Chapter 2: The Philippines – key to the biogeography of Wallacea? – Pp. 19–34 *in:* Knight, W. J., & Holloway, J. D. (eds.), Insects and the rain forests of South East Asia (Wallacea). – London (Royal Entomological Society), iv + 343 pp.

Wang H. Y. (1994): Illustrations of giant silkmoths & carpenter moths in Taiwan [in Chinese]. – Taipei (Shu Shin Books), [4] + 138 pp.

Received: 3. iv. 2008

© Entomologischer Verein Apollo e. V., Frankfurt am Main, August 2008 ISSN 0723-9912

© Entomologischer Verein Apollo e. V., Frankfurt am Main